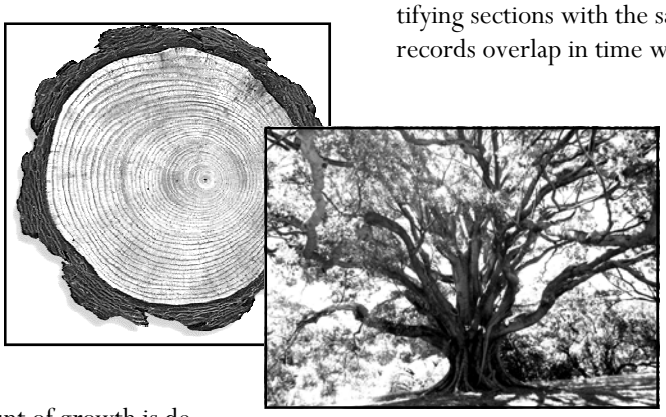
# Using "Tree Cookies" to Study Climate Change

*Activity compiled courtesy of: "The Wright Center for Science Education"*

When trees grow, they add new material around the outside layer. Trees that experience distinct winter and summer seasons, like those in Maine, only grow in the summer season and lie dormant in the winter. As each new growth layer/ring is added, its size is determined by how much growth takes place during the growing season. The amount of growth is dependent on the amount of water the tree receives. Longer or wetter summers produce larger growth rings on trees. The measurement of rings on a tree is an excellent means of determining the amount of growth that took place in any growing season. From that, the length of summer and amount of precipitation (weather) can be interpreted. Any tree, then, can be used to interpret long-term weather or climate. Though some trees generally do not live to be very old (relative to the geological time record), there are trees that live thousands of years and provide longer climate records. Records from young trees, old trees, house and ship timbers and fossil trees can be tied together by identifying sections with the same sequence of climatic events-the records overlap in time where the climatic patterns match up. Through correlating different wood samples, scientists have been able to derive a record of climate change that is 16,000+years long.



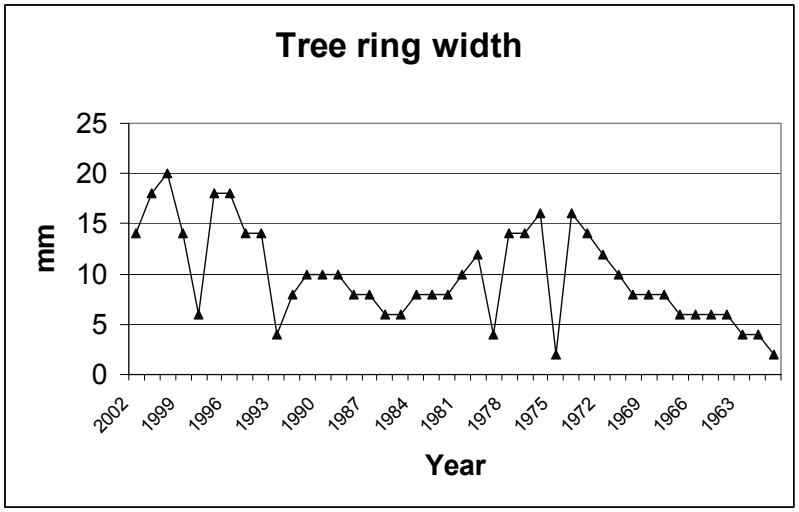
Different tree species are also better indicators of climate change (long term weather) because each species is adapted to specific climatic regions. As climate changes, tree species repopulate different regions. The "migration" of many trees towards the poles and higher elevations has been observed as the Earth's average temperature increases.

In this activity, students will understand how tree rings are indicators of weather, and quantify the size of tree rings and interpret weather and climate change. Students will then use simulated tree cores to replicate how scientists used tree rings to study how climate has changed over time. Check out <*www.sonic.net/bristlecone/dendro.html*> for more background information.

## Part A

**Procedure:**

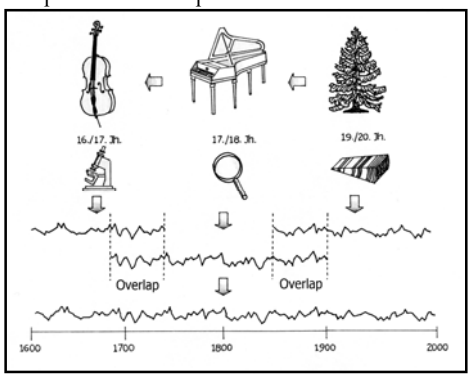
1. Obtain as many "tree cookies", or cross sections of trees as possible. You can call your local forester who will be happy to supply you with cookies. You may also be able to borrow or rent a boring device to take actual samples from living trees. However, boring devices can be sharp and dangerous without proper instruction. DO NOT cut down trees just for this exercise.
2. Divide students into groups and give each group a tree cookie, a small metric ruler, a magnifying lens, paper, and pencil.
3. Using a magnifying lens, observe the tree rings. Are all tree rings uniform and the same color? What could account for the differences in color and width of the rings?




Graphic credits: www.chemsoc.org/networks/learnet/jesei/treering/index.htm

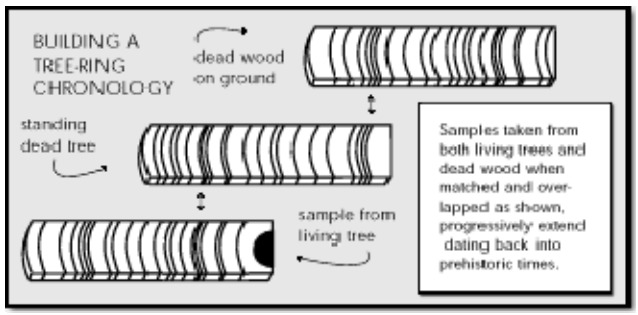
4. Place one corner of one end of a piece of paper at the center of the tree cookie and use the long edge of the paper as a straight edge to the outside of the tree cookie.
5. Starting at the center of the tree cookie, students should count the number of rings to the outside/last layer, marking the location of each ring on the paper.
6. Identify and record the locations of the thickest and thinnest rings.
7. Measure the thickness of each ring (between each of the marks made on the paper).
8. Draw measurements as a bar or line graph (thickness versus year).

Graphic credits: http://www.mdw.ac.at/I105/orpheon/Seiten/education/DendroBeutingText.htm



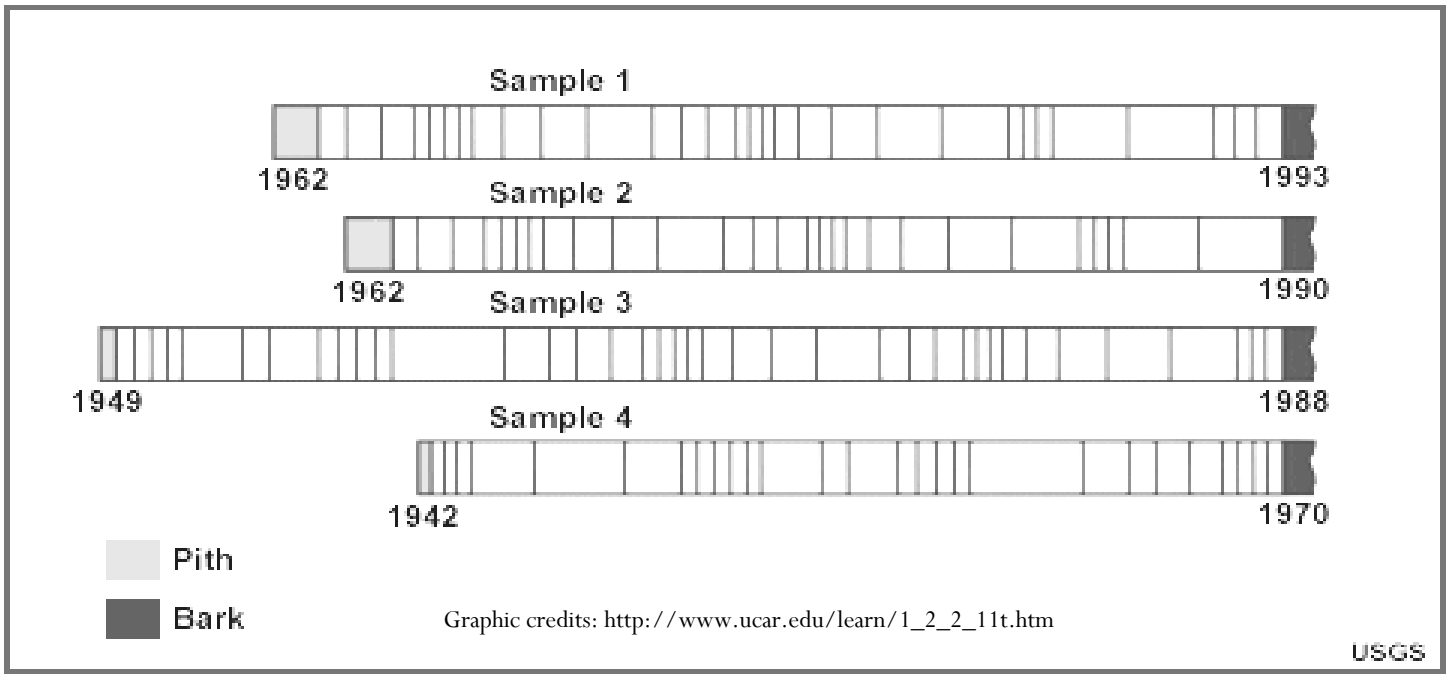

## Part B.

Now that students have seen how tree rings can be used to determine yearly weather change, they are ready to sample techniques involved in reconstructing climate history. It is best to use cut outs of the strips below. The second website listed at the bottom of this page also has cuts outs which can be used. It is encouraged not to use real tree cookies unless you know the exact year and locations they were taken.




Graphic credits: http://www.sonic.net/bristlecone/dendro.html

1. Using the sample tree cores below, cut out one set for each group of students, leaving only the year 1993 on sample one.
2. Use the ring patterns to match up the tree samples. When two trees were alive at the same time and in the same geographical area, they experienced the same growing conditions so should show the same pattern of tree rings. Once lined up, tape the three cores together.
3. How much time do the lives of the three trees span together? Label the years on the paper strips as you count the rings.
4. Measure the width of all the tree rings and record them in a table along with their year. Remember, only count the overlapping sections once and draw a graph of the width of the tree versus the year, as in number eight of part A.




Graphic credits: http://www.ucar.edu/learn/1_2_2_11t.htm

### Questions

1. What do the graphs of tree-ring width versus time represent?
2. Give a brief and general description of how the climate (and growing conditions) might have changed during the period that your tree samples represent.
3. How could we get climatic information further back in time than tree rings can provide?
4. If carbon dioxide levels are rising, and global warming continues, what difference would you expect to see in the tree rings between modern ones and those laid down over 100 years?

### Resources

http://www.tufts.edu/as/wright_center/iecws/materials/dendrochronology.pdf
http://www.chemsoc.org/networks/learnnet/jesei/treering/index.htm